the stock and fasten to the fixture using a 5/16" hex head machine screw and a large flat washer. Be sure there is adequate clearance between the bottom of the stock and the vise to cut through the entire piece.

7. Insert a 3/8" steel dowel in the mill to locate the dowel hole on the fixture. Remove the dowel.

8. Insert the specified cutter. Zero the *x*, *y*, and *z* axes. Run program M. GAUGE 2 (Fig. 4).

9. Drill (no. 7) and tap (1/4-20 UNC) the hole in the top of the gauge head.

10. Polish all parts.

11. Cut and bend the brass shim to the dimensions shown (Fig. 1). This is used to protect the handle from the thumb screw.

12. Assemble the project.

Both programs utilize a variable macro instruction. The macro instruction commands the machine to move the cutter in the same path increasing the *z* value by -0.100 with each cut. The command for the macro is $. This is succeeded by =1Z* and the new *z* value for each cut. All other commands are provided in standard word address format. □

```
;Marking Gauge Center Hole
;250 Carbide 4 Flute Center Cutting End Mill
;2000RPM
;Hold In Vise

.N5 GO G17 G30 G70 G75 G90 T1 M6
.N10 G1 F50

N15 GO X-.222 Y.125
#1
N20 Z* F10
N25 G1 F50
N30 G3 X.222 Y.125 IO JO F50
N35 G1 X-.222
$
=1Z* -.600
=1Z* -.700
=1Z* -.800
=1Z* -.900
=1Z* -1.020
N30 GO XO YO M2
```

Fig. 3—Program M. GAUGE 1

```
;Marking Gauge Body
;250 Carbide 4 Flute Center Cutting End Mill
;2000RPM
;Hold In Fixture

.N5 GO G17 G30 G70 G75 G90 T1 M6
.N10 G1 F50

N15 GO X-.422 Y.433
#1
N25 Z*F10
N30 G1 F50
N35 G3 X.422 Y.433 IO J.875 F50
N40 G1 X1.442 Y1.433
N45 G3 X1 Y2.5 I1 J1.875
N50 G1 X-1
N55 G3 X-1.442 Y1.433 I-1 J1.875
N60 G1 X-.422 Y.433
$
=#1Z* -.600
=#1Z* -.700
=#1Z* -.800
=#1Z* -.900
=#1Z* -1.020
N65 GO XO YO M2
```

Fig. 4—Program M. GAUGE 2

Index to Volume 48

The material listed in this index of Volume 48 (August 1988-May 1989) of SCHOOL SHOP is arranged alphabetically by both author and subject (e.g., woodworking, machine shop, etc.). Following the author and title of each feature are the issue month and page number.

A

Aadahl, Richard. Teach Construction Students Surveying Methods with This Primitive Transit. Feb., 22.

AUTO SHOP

Handy Auto Cradle Facilitates Service Work and Instruction. R. Lewis McCaw, Jr. Dec., 15.

Recording Helps Auto Students Properly Diagnose Engine Noises. Robert V. Colangelo. Feb., 15.

Your Students Should Know about Alcohol/Gasoline Mixes. Dennis Karwatka. Jan., 28.

B

Bailey, Greg W. Reducing Accident Liability through Industrial Standards. Mar., 29.

Balmer, Thomas A. Marking Gauge Project Gives Students CNC Experience. May, 29.

Baxter, Jim. Using the Contract System in the Woodworking Lab. Oct., 37.

Becker, Alan, and Elka Gould. Experimenting with Photo Etching Encourages Student Creativity. Mar., 23.

——, Samuel R. Rubinstein, and Elka Gould. These Two Aids Help Students Learn about Depth of Field. Nov., 24.

Berghauser, Tom. Helpful Advice on Establishing a CAD, CAM, and CIM Lab. Sept., 34.

Berthelot, Ronald, and George G. Hendrickson. Program Helps a Variety of Learners with Solving AC Theory Problems. Nov., 19.

Bohn, Muriel. Twisting Teaser Teaches Technology Terminology. Nov., 44.

Brady, Gary. Old-Style Post-and-Beam Barn Built by Carpentry Students. Jan., 20.

Buzzell, Charles. Future Work Force Needs: Finding the Hidden Truth. Apr., 22.

C

Carter, Lee, and Jerry Sweet. Taking a Diversified Approach with All Drafting Instruction. Aug., 19.

——. Teach Students Orthographic Projection with Play-Doh Models. Mar., 36.

Cobb, R. Brian, and Michael D. Wright. Changes Ahead Offer the Field a Far Brighter Tomorrow. Apr., 36.

Colangelo, Robert V. Recording Helps Auto Students Properly Diagnose Engine Noises. Feb., 15.

Colombo, Donald. Sheet-Metal Model Airplane Makes a Good TE Project. Mar., 28.

COMPUTER PROGRAMS

Computer Program Estimtes Platemaking, Proofing Costs. Harry E. Watts. Jan., 36.

Computer Program Generates Math Skills Worksheets. Emmett Mason. Sept., 31.

Computer Program Identifies Different Types of Wood. Richard A. Kruppa. Jan., 22.

Creating a Computerized Reference Data Base. Anthony D. Giordano. Mar., 24.

Individualized Math Worksheet: A Graphic Arts Application. Emmett Mason. Oct., 26.

Microprocessor Spreadsheet Has Many IE Applications. Jerome Gunderson. Feb., 16.

Program Hastens Solution of DC Network Problems. George G. Hendrickson. May, 20.

Program Helps a Variety of Learners with Solving AC Theory Problems. Ronald Berthelot and George G. Hendrickson. Nov., 19.

This Computer Program Makes Process Camera Calculations. Keith A. Stenehjem. Dec., 12.

COMPUTERS

Explore 'Thinking' Computers through Expert System Programs. Walter F. Deal. Mar., 25.

Learner Friendly Robot Shows the Basics of Computer Control. Dennis D. Davis. Aug., 14.

Speed Computer Operation with This Modification. Ronald Helvey. Jan., 32.

Use Data Acquisition and Control to Show the Computer's Potential. Ron Kovac. Sept., 23.

Conroy, Michael T. Add Basic Communication Skills to Industrial/Technology Classes. May, 13.

Cope, Thomas R. Follow Right-to-Know Legislation in the Vocational/Technology Lab. Oct., 34.

D

Davis, Dennis D. Learner Friendly Robot Shows the Basics of Computer Control. Aug., 14.

Deal, Walter F. Explore 'Thinking' Computers through Expert System Programs. Mar., 25.

DIRECTORY OF FEDERAL AND STATE OFFICIALS. Sept., 45.

DIRECTORY OF SUPPLIERS. Apr., 47.

Dorn, Richard H., and Thomas K. Farmer. Imitate Industry Practice with $10 Lathe Duplicator. Feb., 24.

DRAFTING/DESIGN

Architecture in Transition: Postmodern Design. George Gow., Feb., 17.

Beyond Drafting Class Alone: CAD Takes New Directions. Paul Drushler. Nov., 17.

Build Student Interest in Drafting through 'Engineering'-Style Projects. Eric Sorensen. Dec., 22.

Give Drafting/Design Students Real-World Experiences in Industry. Yuan H. Liu. Oct., 25.

Helpful Advice on Establishing a CAD, CAM, and CIM Lab. Tom Berghauser. Sept., 34.

Outfitting Your CAD Lab—at Minimal Expense. Wendell Roy. May, 16.

Produce Inexpensive Materials for Architectural Model Making. George D. Roberts. Jan., 27.

Taking a Diversified Approach with All Drafting Instruction. Lee Carter and Jerry Sweet. Aug., 19.

Teach Students Orthographic Projection with Play-Doh Models. Lee Carter and Jerry Sweet. Mar., 36.

Drushler, Paul. Beyond Drafting Class Alone: CAD Takes New Directions. Nov., 17.

Dugger, William E., Jr., Forest S. Fowler, Alan H. Jones, and Kendall N. Starkweather. Fourth Annual Survey—SCHOOL SHOP Readers Provide Up-to-Date View of the Field. Nov., 13.

——. State Supervisors Report on TE and T&I Programs. May, 23.

E

ELECTRICITY/ELECTRONICS

Electronics Students Can Build This Low-Cost High-Power Amp. Bruce McLennan. Sept., 26.

Handy Extractor Aids in IC/DIP Removal. R. L. Helvey. Sept., 40.

Hybrid Logic Probe Shows Operation of Logic Circuits. Hershel D. Standard. Feb., 14.

Industrial Technician Training Needs to Include the P.L.C. Nicholas Reitter. Jan., 34.

Low-Cost PC Breadboard Solves Many Problems. Clarke Homoly. Oct., 31.

Program Hastens Solution of DC Network Problems. George G. Hendrickson. May, 20.

Program Helps a Variety of Learners with Solving AC Theory Problems. Ronald Berthelot and George G. Hendrickson. Nov., 19.

A Ramp and Pulse Generator Improves Electronics Instruction. Daniel N. Myers. Mar., 21.

'Robot Eyes' Bring Life to Differential Amplifier. Joseph Szumowski. Aug., 23.

This Self-Activating Night-Light Offers Good Electronics Practice. Allan Kaufman. Dec., 16.

This Voltage Amplifier Trainer Teaches Troubleshooting Methods. Jack Wamble. Mar., 34.

Windshield Fluid Indicator Is a Useful Electronics Project. Charles Shoemaker. Feb., 20.

Erekson, Thomas L. The Future Holds Promise of Continuing Change. Apr., 20.

F

Farmer, Thomas K., and Richard H. Dorn. Imitate Industry Practice with $10 Lathe Duplicator. Feb., 24.

Fisher, Jim. Foamworking: Speedy, Cheap, Loaded with Practice of Skills. Oct., 28.

Foster, Hugh. Biscuit Joiner Brings Strength, Speed to Wood-Jointing Process, May, 27.

Foster, W. Tad. Making an Accurate Selection of the Most Appropriate Text. Dec., 26.

Fowler, Forest S., Alan H. Jones, Kendall N. Starkweather, and William E. Dugger, Jr. Fourth Annual Survey—SCHOOL SHOP Readers Provide Up-to-Date View of the Field. Nov., 13.

——. State Supervisors Report on TE and T&I Programs. May, 23.

FROM WASHINGTON. Anne C. Lewis. Aug., 40; Sept., 72; Oct., 64; Nov., 68; Dec., 48; Jan., 48; Feb., 40; Mar., 64; Apr., 88; May, 40.

the stock and fasten to the fixture using a 5/16" hex head machine screw and a large flat washer. Be sure there is adequate clearance between the bottom of the stock and the vise to cut through the entire piece.

7. Insert a 3/8" steel dowel in the mill to locate the dowel hole on the fixture. Remove the dowel.

8. Insert the specified cutter. Zero the *x*, *y*, and *z* axes. Run program M. GAUGE 2 (Fig. 4).

9. Drill (no. 7) and tap (1/4-20 UNC) the hole in the top of the gauge head.

10. Polish all parts.

11. Cut and bend the brass shim to the dimensions shown (Fig. 1). This is used to protect the handle from the thumb screw.

12. Assemble the project.

Both programs utilize a variable macro instruction. The macro instruction commands the machine to move the cutter in the same path increasing the *z* value by -0.100 with each cut. The command for the macro is $. This is succeeded by =1Z* and the new *z* value for each cut. All other commands are provided in standard word address format. □

```
;Marking Gauge Center Hole
;250 Carbide 4 Flute Center Cutting End Mill
;2000RPM
;Hold In Vise

.N5 GO G17 G30 G70 G75 G90 T1 M6
.N10 G1 F50

N15 GO X-.222 Y.125
#1
N20 Z* F10
N25 G1 F50
N30 G3 X.222 Y.125 IO JO F50
N35 G1 X-.222
$
=1Z* -.600
=1Z* -.700
=1Z* -.800
=1Z* -.900
=1Z* -1.020
N30 GO XO YO M2
```

Fig. 3—Program M. GAUGE 1

```
;Marking Gauge Body
;250 Carbide 4 Flute Center Cutting End Mill
;2000RPM
;Hold In Fixture

.N5 GO G17 G30 G70 G75 G90 T1 M6
.N10 G1 F50

N15 GO X-.422 Y.433
#1
N25 Z*F10
N30 G1 F50
N35 G3 X.422 Y.433 IO J.875 F50
N40 G1 X1.442 Y1.433
N45 G3 X1 Y2.5 I1 J1.875
N50 G1 X-1
N55 G3 X-1.442 Y1.433 I-1 J1.875
N60 G1 X-.422 Y.433
$
=#1Z* -.600
=#1Z* -.700
=#1Z* -.800
=#1Z* -.900
=#1Z* -1.020
N65 GO XO YO M2
```

Fig. 4—Program M. GAUGE 2

Index to Volume 48

The material listed in this index of Volume 48 (August 1988-May 1989) of SCHOOL SHOP is arranged alphabetically by both author and subject (e.g., woodworking, machine shop, etc.). Following the author and title of each feature are the issue month and page number.

A

Aadahl, Richard. Teach Construction Students Surveying Methods with This Primitive Transit. Feb., 22.

AUTO SHOP

Handy Auto Cradle Facilitates Service Work and Instruction. R. Lewis McCaw, Jr. Dec., 15.

Recording Helps Auto Students Properly Diagnose Engine Noises. Robert V. Colangelo. Feb., 15.

Your Students Should Know about Alcohol/Gasoline Mixes. Dennis Karwatka. Jan., 28.

B

Bailey, Greg W. Reducing Accident Liability through Industrial Standards. Mar., 29.

Balmer, Thomas A. Marking Gauge Project Gives Students CNC Experience. May, 29.

Baxter, Jim. Using the Contract System in the Woodworking Lab. Oct., 37.

Becker, Alan, and Elka Gould. Experimenting with Photo Etching Encourages Student Creativity. Mar., 23.

——, Samuel R. Rubinstein, and Elka Gould. These Two Aids Help Students Learn about Depth of Field. Nov., 24.

Berghauser, Tom. Helpful Advice on Establishing a CAD, CAM, and CIM Lab. Sept., 34.

Berthelot, Ronald, and George G. Hendrickson. Program Helps a Variety of Learners with Solving AC Theory Problems. Nov., 19.

Bohn, Muriel. Twisting Teaser Teaches Technology Terminology. Nov., 44.

Brady, Gary. Old-Style Post-and-Beam Barn Built by Carpentry Students. Jan., 20.

Buzzell, Charles. Future Work Force Needs: Finding the Hidden Truth. Apr., 22.

C

Carter, Lee, and Jerry Sweet. Taking a Diversified Approach with All Drafting Instruction. Aug., 19.

——. Teach Students Orthographic Projection with Play-Doh Models. Mar., 36.

Cobb, R. Brian, and Michael D. Wright. Changes Ahead Offer the Field a Far Brighter Tomorrow. Apr., 36.

Colangelo, Robert V. Recording Helps Auto Students Properly Diagnose Engine Noises. Feb., 15.

Colombo, Donald. Sheet-Metal Model Airplane Makes a Good TE Project. Mar., 28.

COMPUTER PROGRAMS

Computer Program Estimtes Platemaking, Proofing Costs. Harry E. Watts. Jan., 36.

Computer Program Generates Math Skills Worksheets. Emmett Mason. Sept., 31.

Computer Program Identifies Different Types of Wood. Richard A. Kruppa. Jan., 22.

Creating a Computerized Reference Data Base. Anthony D. Giordano. Mar., 24.

Individualized Math Worksheet: A Graphic Arts Application. Emmett Mason. Oct., 26.

Microprocessor Spreadsheet Has Many IE Applications. Jerome Gunderson. Feb., 16.

Program Hastens Solution of DC Network Problems. George G. Hendrickson. May, 20.

Program Helps a Variety of Learners with Solving AC Theory Problems. Ronald Berthelot and George G. Hendrickson. Nov., 19.

This Computer Program Makes Process Camera Calculations. Keith A. Stenehjem. Dec., 12.

COMPUTERS

Explore 'Thinking' Computers through Expert System Programs. Walter F. Deal. Mar., 25.

Learner Friendly Robot Shows the Basics of Computer Control. Dennis D. Davis. Aug., 14.

Speed Computer Operation with This Modification. Ronald Helvey. Jan., 32.

Use Data Acquisition and Control to Show the Computer's Potential. Ron Kovac. Sept., 23.

Conroy, Michael T. Add Basic Communication Skills to Industrial/Technology Classes. May, 13.

Cope, Thomas R. Follow Right-to-Know Legislation in the Vocational/Technology Lab. Oct., 34.

D

Davis, Dennis D. Learner Friendly Robot Shows the Basics of Computer Control. Aug., 14.

Deal, Walter F. Explore 'Thinking' Computers through Expert System Programs. Mar., 25.

DIRECTORY OF FEDERAL AND STATE OFFICIALS. Sept., 45.

DIRECTORY OF SUPPLIERS. Apr., 47.

Dorn, Richard H., and Thomas K. Farmer. Imitate Industry Practice with $10 Lathe Duplicator. Feb., 24.

DRAFTING/DESIGN

Architecture in Transition: Postmodern Design. George Gow., Feb., 17.

Beyond Drafting Class Alone: CAD Takes New Directions. Paul Drushler. Nov., 17.

Build Student Interest in Drafting through 'Engineering'-Style Projects. Eric Sorensen. Dec., 22.

Give Drafting/Design Students Real-World Experiences in Industry. Yuan H. Liu. Oct., 25.

Helpful Advice on Establishing a CAD, CAM, and CIM Lab. Tom Berghauser. Sept., 34.

Outfitting Your CAD Lab—at Minimal Expense. Wendell Roy. May, 16.

Produce Inexpensive Materials for Architectural Model Making. George D. Roberts. Jan., 27.

Taking a Diversified Approach with All Drafting Instruction. Lee Carter and Jerry Sweet. Aug., 19.

Teach Students Orthographic Projection with Play-Doh Models. Lee Carter and Jerry Sweet. Mar., 36.

Drushler, Paul. Beyond Drafting Class Alone: CAD Takes New Directions. Nov., 17.

Dugger, William E., Jr., Forest S. Fowler, Alan H. Jones, and Kendall N. Starkweather. Fourth Annual Survey—SCHOOL SHOP Readers Provide Up-to-Date View of the Field. Nov., 13.

——. State Supervisors Report on TE and T&I Programs. May, 23.

E

ELECTRICITY/ELECTRONICS

Electronics Students Can Build This Low-Cost High-Power Amp. Bruce McLennan. Sept., 26.

Handy Extractor Aids in IC/DIP Removal. R. L. Helvey. Sept., 40.

Hybrid Logic Probe Shows Operation of Logic Circuits. Hershel D. Standard. Feb., 14.

Industrial Technician Training Needs to Include the P.L.C. Nicholas Reitter. Jan., 34.

Low-Cost PC Breadboard Solves Many Problems. Clarke Homoly. Oct., 31.

Program Hastens Solution of DC Network Problems. George G. Hendrickson. May, 20.

Program Helps a Variety of Learners with Solving AC Theory Problems. Ronald Berthelot and George G. Hendrickson. Nov., 19.

A Ramp and Pulse Generator Improves Electronics Instruction. Daniel N. Myers. Mar., 21.

'Robot Eyes' Bring Life to Differential Amplifier. Joseph Szumowski. Aug., 23.

This Self-Activating Night-Light Offers Good Electronics Practice. Allan Kaufman. Dec., 16.

This Voltage Amplifier Trainer Teaches Troubleshooting Methods. Jack Wamble. Mar., 34.

Windshield Fluid Indicator Is a Useful Electronics Project. Charles Shoemaker. Feb., 20.

Erekson, Thomas L. The Future Holds Promise of Continuing Change. Apr., 20.

F

Farmer, Thomas K., and Richard H. Dorn. Imitate Industry Practice with $10 Lathe Duplicator. Feb., 24.

Fisher, Jim. Foamworking: Speedy, Cheap, Loaded with Practice of Skills. Oct., 28.

Foster, Hugh. Biscuit Joiner Brings Strength, Speed to Wood-Jointing Process, May, 27.

Foster, W. Tad. Making an Accurate Selection of the Most Appropriate Text. Dec., 26.

Fowler, Forest S., Alan H. Jones, Kendall N. Starkweather, and William E. Dugger, Jr. Fourth Annual Survey—SCHOOL SHOP Readers Provide Up-to-Date View of the Field. Nov., 13.

——. State Supervisors Report on TE and T&I Programs. May, 23.

FROM WASHINGTON. Anne C. Lewis. Aug., 40; Sept., 72; Oct., 64; Nov., 68; Dec., 48; Jan., 48; Feb., 40; Mar., 64; Apr., 88; May, 40.

G

GENERAL SHOP

Silk-Screened Bulletin Board Offers Basic Shop Experience. Rickey Mudd. Nov., 39.

Giordano, Anthony D. Creating a Computerized Reference Data Base. Mar., 24.

Gould, Elka, and Alan Becker. Experimenting with Photo Etching Encourages Student Creativity. Mar., 23.

——, Samuel R. Rubinstein, and Alan Becker. These Two Aids Help Students Learn about Depth of Field. Nov., 24.

Gow, George. Architecture in Transition: Postmodern Design. Feb., 17.

GRAPHIC ARTS

Computer Program Estimates Platemaking, Proofing Costs. Harry E. Watts. Jan., 36.

Experimenting with Photo Etching Encourages Student Creativity. Alan Becker and Elka Gould. Mar., 23.

Individualized Math Worksheet: A Graphic Arts Application. Emmett Mason. Oct., 26.

These Two Aids Help Students Learn about Depth of Field. Alan Becker, Samuel R. Rubinstein, and Elka Gould. Nov., 24.

This Computer Program Makes Process Camera Calculations. Keith A. Stenehjem. Dec., 12.

Trivia Exam Motivates Class, Teaches Graphic Arts Basics. Dale F. Hughes. Sept., 37.

Use Basic Hand Tools to Cut and Trim Paper. Rodney W. Hanson. Aug., 17.

Gunderson, Jerome. Microprocessor Spreadsheet Has Many IE Applications. Feb., 16.

H

Hammer, Douglas E. What Vo-Ed Must Do to Soar into the Future. Apr., 40.

Hannaman, Lynn, and L. Leslie Rosso. Sandblasted Wooden Signs Offer Creative Possibilities. Aug., 21.

Hanson, Rodney W. Use Basic Hand Tools to Cut and Trim Paper. Aug., 17.

Hartmann, Edward A. Scriber Project Teaches Introductory CNC Skills. Jan., 33.

Helvey, R. L. Handy Extractor Aids in IC/DIP Removal. Sept., 40.

——. Speed Computer Operation with This Modification. Jan., 32.

Hendrickson, George C. Program Hastens Solution of DC Network Problems. May, 20.

——, and Ronald Berthelot. Program Helps a Variety of Learners with Solving AC Theory Problems. Nov., 19.

Hetrick, Scott. Sheet-Metal Rack Offers Compact Vertical Storage. Aug., 22.

Homoly, Clarke. Low-Cost PC Breadboard Solves Many Problems. Oct., 31.

Howell, David, and Thomas G. Liddy. Dovetailing Psychological Theory and Hands-on Practice in IA. Sept., 21.

Hughes, Dale F. Trivia Exam Motivates Class, Teaches Graphic Arts Basics. Sept., 37.

I

INDUSTRIAL ARTS/TECHNOLOGY EDUCATION

Add Basic Communication Skills to Industrial/Technology Classes. Michael T. Conroy. May, 13.

Changes Ahead Offer the Field a Far Brighter Tomorrow. Michael D. Wright and R. Brian Cobb. Apr., 36.

Considering the Transition from IA to TE. Donald Maley. Apr., 33.

Designing Class Activities to Suit a Technology Education Approach. Kim C. Wellington. Feb., 11.

Dovetailing Psychological Theory and Hands-On Practice in IA. Thomas G. Liddy and David Howell. Sept., 21.

Expanding Traditional Borders of Industrial Education. Kendall N. Starkweather. Apr., 32.

Fourth Annual Survey—SCHOOL SHOP Readers Provide Up-to-Date View of the Field. William E. Dugger, Jr., Forest S. Fowler, Alan H. Jones, and Kendall N. Starkweather. Nov., 13.

The Future Holds Promise of Continuing Change. Thomas L. Erekson. Apr., 20.

Future Work Force Needs: Finding the Hidden Truth. Charles Buzzell. Apr., 22.

Grid Template Makes Reading Function Curves More Accurate. M. S. Mir. Feb., 13.

IE Should Have a Valued Role in Education's Changing World. Frederick G. Welch Apr., 24.

Instructor Really Stretches His Materials Budget. Rita A. Wigg. May, 18.

Making an Accurate Selection of the Most Appropriate Text. W. Tad Foster. Dec., 26.

Moving Beyond the Reagan Years in IA, TE, and Vo-Ed. Alan H. Jones. Apr., 19.

Selling Students the Three T's: Tools, Technology, and Thinking. Jane Mobley. Dec., 9.

Share Your Shop and Build Community Support with 'ELF' Activity. Peter W. Kemp. Dec., 24.

Sputnik and *A Nation at Risk*: Milestones of Challenge. Kenneth Welty. Apr., 26.

State Supervisors Report on TE and T&I Programs. William E. Dugger, Jr., Forest S. Fowler, Alan H. Jones, and Kendall N. Starkweather. May, 23.

Student Group Reflects on a Decade of Development. Rosanne T. White. Apr., 34.

Taking a Long, Close Look at What May Lie Ahead. Robert V. Kerwood and Melle Starsen. Apr., 41.

Teaching Technology Education. Emmett Watson. Oct., 23.

Teaching the Importance of Storage and Retrieval. John F. Nennig. Oct., 36.

TE Students Can Mass Produce Useful Items for Their School. Samuel M. Turner and Marshall S. Turner. Jan., 30.

Technology Education: Recent Past and Future. Donald Maley. Apr., 29.

Twisting Teaser Teaches Technology Terminology. Muriel Bohn. Nov., 44.

Using Games in Class Wins Student Attention. Melvin J. Pedras and Barry Smith. Nov., 26.

We Need Your Input—Be a Part of Our 5th Annual Survey. May, 33.

What Vo-Ed Must Do to Soar into the Future. Douglas E. Hammer. Apr., 40.

INSTRUCTIONAL MATERIALS DIRECTORY. Dec., 25.

J

Jones, Alan H. Moving Beyond the Reagan Years in IA, TE, and Vo-Ed. Apr., 19.

——, Kendall N. Starkweather, William E. Dugger, Jr., and Forest S. Fowler. Fourth Annual Survey—SCHOOL SHOP Readers Provide Up-to-Date View of the Field. Nov., 13.

——, Kendall N. Starkweather, William E. Dugger, Jr., and Forest S. Fowler. State Supervisors Report on TE and T&I Programs. May, 23.

K

Karwatka, Dennis. Your Students Should Know about Alcohol/Gasoline Mixes. Jan., 28.

Kaufman, Allan. This Self-Activating Night-Light Offers Good Electronics Practice. Dec., 16.

Kemp, Peter W. Share Your Shop and Build Community Support with 'ELF' Activity. Dec., 24.

Kerwood, Robert V., and Melle Starsen. Taking a Long, Close Look at What May Lie Ahead. Apr., 41.

Kinnaman, Donald. Getting Your Shop Organized with the Perfect Clamp Rack. Dec., 17.

Kovac, Ron. Use Data Acquisition and Control to Show the Computer's Potential. Sept., 23.

Kruppa, Richard A. Computer Program Identifies Different Types of Wood. Jan., 27.

Kulick, Susan. LEP Students Succeed in Vo-Ed through Special Support Services. Feb., 19.

L

Liddy, Thomas G., and David Howell. Dovetailing Psychological Theory and Hands-On Practice in IA. Sept., 21.

Liu, Yuan H. Give Drafting/Design Students Real-World Experiences in Industry. Oct., 25.

M

MACHINE SHOP

Choose the Right Equipment for Effective CNC Training. Morton Margules. Feb., 26.

Helpful Advice on Establishing a CAD, CAM, and CIM Lab. Tom Berghauser. Sept., 34.

Marking Gauge Project Gives Students CNC Experience. Thomas A. Balmer. May, 29.

Scriber Project Teaches Introductory CNC Skills. Edward A. Hartmann. Jan., 33.

Makuck, Edward, and Vincent Voiiono. Foamworking Application: Recreating the Liberty Bell. Oct., 30.

Maley, Donald. Considering the Transition from IA to TE. Apr., 33.

——. Technology Education: Recent Past and Future. Apr., 29.

MANUFACTURING

Helpful Advice on Establishing a CAD, CAM, and CIM Lab. Tom Berghauser. Sept., 34.

Production Systems Provide Good Capstone Experience. John R. Wright. Aug., 11.

Teaming Up to Provide Instruction on Flexible Manufacturing Systems. Diane McDonald. Mar., 19.

Margules, Morton. Choose the Right Equipment for Effective CNC Training. Feb., 26.

Mason, Emmett. Computer Program Generates Math Skills Worksheets. Sept., 31.

——. Individualized Math Worksheet: A Graphic Arts Application. Oct., 26.

Mayfield, Rex. Inexpensive Stand Eases Small Engine Instruction and Work. Nov., 18.

McCaw, R. Lewis. Handy Auto Cradle Facilitates Service Work and Instruction. Dec., 15.

McDonald, Diane. Teaming Up to Provide Instruction on Flexible Manufacturing Systems. Mar., 19.

McLennan, Bruce. Electronics Students Can Build This Low-Cost High-Power Amp. Sept., 26.

METALSHOP

Casting Process Can Teach Crafts and Mass Production. Daniel P. Quinn. Dec., 20.

Sheet-Metal Model Airplane Makes a Good TE Project. Donald Colombo. Mar., 28.

Sheet-Metal Rack Offers Compact Vertical Storage. Scott Hetrick. Aug., 22.

A Ski-Trail Groomer Made from Scrap Metal Develops Good Problem-Solving Skills. Ronald J. Silvia. Nov., 29.

Miles, David. Project Grading Sheet Provides Fair, Accurate Evalution. May, 15.

Mir, M. S. Grid Template Makes Reading Function Curves More Accurate. Feb., 13.

TECHNOLOGY ELECTRONICS

THE STARTING POINT FOR ELECTRONICS

MODERN ELECTRONICS is an introductory course in the basics of Electricity-Electronics. We have used a minimum amount of math to make it easier for the student to understand the concepts without getting swamped in the equations. Topics and experiments are explained in a simplified manner. Each experiment can be covered in a single class period. All required technical material is presented. Hands-on student project breadboard is also part of the program. ED-LAB 500

SATELLITE COMMUNICATIONS

The CES SATELLITE SYSTEM CES 230 is composed of three components, a Transmitter Station, a Receiver Station, and the Satellite Station. This system is used to demonstrate the concept of Telecommunication Systems. The Transmitter sends a signal to the Satellite which is amplified and transmitted back to the receiving station. The signal is transmitted by varying the intensity of a light beam. An experiment manual is included in the package. CES 230

All components are permanently mounted so they cannot get broken or lost and all parts are protected against being burned-out due to any incorrect wiring.

WRITE OR CALL TOLL FREE FOR FREE DETAILS AND OUTLINES

CES INDUSTRIES, INC.
130 Central Avenue
Farmingdale, New York 11735
1-800 CES LAB1 (Outside N.Y. State) 1-800 CES LAB2 (N.Y. State Only) Phone (516) 293-4420

ED-LAB

Circle No. 26

Mobley,Jane. Selling Students the Three T's: Tools, Technology, and Thinking, Dec., 9.
Mudd, Rickey. Silk-Screened Bulletin Board Offers Basic Shop Experience. Nov., 39.
Myers, Daniel N. A Ramp and Pulse Generator Improves Electronics Instruction. Mar., 21.

N

Nennig, John F. Teaching the Importance of Storage and Retrieval. Oct., 36.

P

Peckham, Susanne. Conference Preview: ITEA Annual Conference to Meet in Dallas. Mar., 42.
——. Convention Preview—This Year's AVA Convention to Meet in St. Louis. Nov., 48.
Pedras, Melvin J., and Barry Smith. Using Games in Class Wins Student Attention. Nov., 26.
PERSPECTIVES
Choose the Right Equipment for Effective CNC Training. Morton Margules. Feb., 26.
Don't Overlook Less-Obvious Benefits Offered by Our Field. Wilbur Wilson. Oct., 38.
One Man's Plea for Reassessing Junior High Course Content. Hugh T. Smith. Nov., 40.
Reactions to Implementing Technology Education. George E. Rogers. Jan., 38.
PLASTICS
Foamworking Application: Recreating the Liberty Bell. Vincent Vollono and Edward Makuck. Oct., 30.
Foamworking: Speedy, Cheap, Loaded with Practice of Skills. Jim Fisher. Oct., 28.
PROFESSIONAL ASSOCIATIONS
Conference Preview: ITEA Annual Conference to Meet in Dallas. Susanne Peckham. Mar., 42.
Convention Preview—This Year's AVA Convention to Meet in St. Louis. Susanne Peckham. Nov., 48.
Student Group Reflects on a Decade of Development. Rosanne T. White. Apr., 34.
Pucillo, John M. Teach Basic Construction Wiring with a 3/4-Scale Frame Room. Aug., 18.

Q

Quinn, Daniel P. Casting Process Can Teach Crafts and Mass Production. Dec., 20.

R

Reitter, Nicholas. Industrial Technician Training Needs to Include the P.L.C. Jan., 34.
Roberts, George D. Produce Inexpensive Materials for Architectural Model Making. Jan., 27.
ROBOTICS
Learner Friendly Robot Shows the Basics of Computer Control. Dennis D. Davis. Aug., 14.
Teaming Up to Provide Instruction on Flexible Manufacturing Systems. Diane McDonald. Mar., 19.
Rogers, George E. Reactions to Implementing Technology Education. Jan., 38.
Rosso, L. Leslie and Lynn Hannaman. Sandblasted Wooden Signs Offer Creative Possibilities. Aug., 21.
Roy, Wendell. Outfitting You CAD Lab—at Minimal Expense. May, 16.
Rubinstein, Samuel R., Elka Gould, and Alan Becker. These Two Aids Help Students Learn about Depth of Field. Nov., 24.

S

Sabo, Richard S. Using Writing Contests to Spur Acquisition of Academic Skills. Oct., 32.
SAFETY
Follow Right-to-Know Legislation in the Vocational/Technology Lab. Thomas R. Cope. Oct., 34.
Reducing Accident Liability through Industrial Standards. Greg W. Bailey. Mar., 29.
SCHOOL SHOP TALK. Alan H. Jones. Are Academic and Vocational Studies Different? Aug., 2. Honoring Our Leaders, Sept. 2. Time to Get Political, Oct., 2. Surveying the Field, Nov., 2. The Evolution of Instructional Materials, Dec., 2. The Continuing Evolution of Woodworking, Jan., 2. Technology as an Imperative, Feb., 2. A Symbiotic Relationship, Mar., 2. Rising from the Ashes, Apr., 2. Study the Field with Us, May, 2.
Schulze, Bob. Mass-Produced Bank Makes a Great Project—and Music! Mar., 31.
Shoemaker, Charles. Windshield Fluid Indicator Is a Useful Electronics Project. Feb., 20.
SHOP ADMINISTRATION
Computer Program Generates Math Skills Worksheets. Emmett Mason. Sept., 31.
Creating a Computerized Reference Data Base. Anthony D. Giordano. Mar., 24.
Microprocessor Spreadsheet Has Many IE Applications. Jerome Gunderson. Feb., 16.
Project Grading Sheet Provides Fair, Accurate Evalution. David Miles. May, 15.
Reinforce Students' Efforts with a Photo Display Board. Ronald Vickers. Nov., 28.
SHOP KINKS. Aug., 9; Sept., 13; Oct., 15; Nov., 8; Dec., 7; Jan., 11; Feb., 9; Mar., 10; Apr., 16, May, 10.
Silvia, Ronald J. A Ski-Trail Groomer Made From Scrap Metal Develops Good Problem-Solving Skills. Nov., 29.
SHOP TEACHERS SERVICE. Oct., 47.
SMALL ENGINES
Engine Model Demonstrates the Four-Stroke Process. Ronald Vickers. Sept., 25.
Inexpensive Stand Eases Small Engine Instruction and Work. Rex Mayfield. Nov., 18.
Smith, Barry, and Melvin J. Pedras. Using Games in Class Wins Student Attention. Nov., 26.
Smith, Hugh T. One Man's Plea for Reassessing Junior High Course Content. Nov., 40.
SOFTWARE REVIEW. Brain L. Duelm. 'Junior Drafter' Package Teaches Drafting and CAD. Jan., 40.
SOFTWARE REVIEW. Mark Schwendau. New 'FastCAD' Software Lives Up to Its Name. Aug., 24; 'Drawingboard': A Compact, Reasonably Priced Digitizer. Sept., 42; 'Drafix 1 Plus' Has Low Price, Ease of Use, Many Functions. Oct., 42; The HIPLOT Plotter: Sturdy, Reliable, and Economical. Nov., 46; CADKEY Offers True 2-D/3-D Computer-Aided Drafting. Dec., 41; 'Micro CADAM': Big Winner in the World of PC CAD. Feb., 28; 'Zip Chip' Speeds Processing with Apple Microcomputers. Mar., 38.
Sorensen, Eric. Build Student Interest in Drafting through 'Engineering'-Style Projects. Dec., 22.
SPECIAL NEEDS
Accepting the Challenge: Addressing Special Needs. Frank Vollbrecht. Sept., 30.
LEP Students Succeed in Vo-Ed through Special Support Services. Susan Kulick. Feb., 19.
Spencer, Albert G. A Woodworking Update: Where Do We Go from Here? Jan., 17.
Standard, Hershel D. Hybrid Logic Probe Shows Operation of Logic Circuits. Feb., 14.
Starkweather, Kendall N. Expanding Traditional Borders of Industrial Education. Apr., 32.
——, William E. Dugger, Jr., Forest S. Fowler, and Alan H. Jones. Fourth Annual Survey—SCHOOL SHOP Readers Provide Up-to-Date View of the Field. Nov., 13.
——, William E. Dugger, Jr., Forest S. Fowler, and Alan H. Jones. State Supervisors Report on TE and T&I Programs. May, 23.
Starsen, Melle, and Robert V. Kerwood. Taking a Long, Close Look at What May Lie Ahead. Apr., 41.
Stenehjem, Keith A. This Computer Program Makes Process Camera Calculations. Dec.,12.
Sweet, Jerry, and Lee Carter. Taking a Diversified Approach with All Drafting Instruction. Aug., 19.
——. Teach Students Orthographic Projection with Play-Doh Models. Mar., 36.
Szumowski, Joseph. 'Robot Eyes' Bring Life to Differential Amplifier. Aug., 23.

T

TECHNOLOGY EDUCATION. See Industrial Arts/Technology Education.
TECHNOLOGY'S PAST. Dennis Karwatka. The Birth of Commercial Railroading. Aug., 26; Wallace Carothers and Nylon. Sept., 57; Everyone Knows His First Name. Oct., 44; The CFR Fuel Research Engine. Nov., 53; George Washington the Surveyor. Dec., 43; Rags to Riches—Michael Pupin. Jan., 42; The First Skyscraper. Feb., 30; The Pioneer Zephyr. Mar., 47; The Steel Plow. Apr., 75. The Selden Patent. May, 11.
TRADE & INDUSTRY
Old-Style Post-and-Beam Barn Built by Carpentry Students. Gary Brady Jan., 20.
Teach Basic Construction Wiring with a 3/4-Scale Frame Room. John M. Pucillo. Aug., 18.
Teach Construction Students Surveying Methods with This Primitive Transit. Richard Aadahl. Feb., 22.
Turner, Marshall S., and Samuel M. Turner. TE Students Can Mass Produce Useful Items for Their School. Jan., 30.
Turner, Samuel M., and Marshall S. Turner. TE Students Can Mass Produce Useful Items for Their School. Jan., 30.

V

Vickers, Ronald. Engine Model Demonstrates the Four-Stroke Process. Sept., 25.
——. Reinforce Students' Efforts with a Photo Display Board. Nov., 28.
Vollbrecht, Frank. Accepting the Challenge: Addressing Special Needs. Sept., 30.
Vollono, Vincent, and Edward Makuck. Foamworking Application: Recreating the Liberty Bell. Oct., 30.

W

Wamble, Jack. This Voltage Amplifier Trainer Teaches Troubleshooting Methods. Mar., 34.
Watson, Emmett. Teaching Technology Education. Oct., 23.
Watts, Harry E. Computer Program Estimates Platemaking, Proofing Costs. Jan., 36.
Welch, Frederick G. IE Should Have a Valued Role in Education's Changing World. Apr., 24.
Wellington, Kim C. Designing Class Activities to Suit a Technology Education Approach. Feb.,11.
WELDING
Sheet-Metal Rack Offers Compact Vertical Storage. Scott Hetrick. Aug., 22.
Using Writing Contests to Spur Acquisition of Academic Skills. Richard S. Sabo. Oct., 32.
Welty, Kenneth. Sputnik and *A Nation at Risk*: Milestones of Challenge. Apr., 26.
White, Rosanne T. Student Group Reflects on a Decade of Development. Apr., 34.
Wigg, Rita A. Instructor Really Stretches His Materials Budget. May, 18.
Wilson, Wilbur. Don't Overlook Less-Obvious Benefits Offered by Our Field. Oct., 38.
WOODSHOP
Biscuit Joiner Brings Strength, Speed to Wood-Jointing Process. Hugh Foster. May, 27.
Computer Program Identifies Different Types of Wood. Richard A. Kruppa. Jan., 22.
Getting Your Shop Organized with the Perfect Clamp Rack. Donald Kinnaman. Dec., 17.
Imitate Industry Practice with $10 Lathe Duplicator. Richard H. Dorn and Thomas K. Farmer. Feb., 24.
Mass-Produced Bank Makes a Great Project—and Music! Bob Schulze. Mar., 31.
Sandblasted Wooden Signs Offer Creative Possibilities. Lynn Hannaman and L. Leslie Rosso. Aug., 21.
Using the Contract System in the Woodworking Lab. Jim Baxter. Oct., 37.
A Woodworking Update: Where Do We Go from Here? Albert G. Spencer. Jan., 17.
Wright, John R. Production Systems Provide Good Capstone Experience. Aug., 11.
Wright, Michael D., and R. Brian Cobb. Changes Ahead Offer the Field a Far Brighter Tomorrow. Apr., 36. □

MAKE YOUR SHOP
SAFER
INSTALL
Saf-Start-Plugs®
TODAY!

MODEL 12-15 SHOWN, OTHER MODELS AVAILABLE

To upgrade shop machines to the latest safety standards: Simply replace the old power cord with a Saf-Start-Plug® (8-foot cord is molded on).

Over 60,000 now in use!

jds products, INC.

3864 Park Drive
El Dorado Hills, CA 95630
(916) 933-2699

MEMBER EDUCATIONAL EXHIBITORS ASSOCIATION

Circle No. 29

"I scaled it up for a condor."